

## Chapter Eight

# Basic Concepts of Chemical Bonding

*1. The correct electron-dot formulation for hydrogen cyanide (HCN) shows:*

- (a) 2 double bonds and two lone pairs of electrons on the N atom.
- (b) 1 C-H bond, 1 C=N bond, 1 lone pair of electrons on the C atom and 1 lone pair of electrons on the N atom.
- (c) 1 C-H bond, 1 C-N bond, 2 lone pairs of electrons on the C atom and 3 lone pairs of electrons on the N atom.
- (d) 1 triple bond between C and N, 1 N-H bond and 2 lone pairs of electrons on the C atom.
- (e) 1 triple bond between C and N, 1 C-H bond and 1 lone pair of electrons on the N atom.

***2. The correct dot formulation for nitrogen trichloride ( $\text{NCl}_3$ ) has:***

- (a) 3 N-Cl bonds and 10 lone pairs of electrons.
- (b) 3 N=Cl bonds and 6 lone pairs of electrons.
- (c) 1 N-Cl bond, 2 N=Cl bonds and 7 lone pairs of electrons.
- (d) 2 N-Cl bonds, 1 N=Cl bond and 8 lone pairs of electrons.
- (e) 3 N-Cl bonds and 9 lone pairs of electrons.

***3. What is the total number of electrons in the correct Lewis dot formula of the sulfite ion ( $\text{SO}_3^{2-}$ )?***

- (a) 8
- (b) 24
- (c) 26
- (d) 30
- (e) 32

***4. In the Lewis structure for the  $\text{OF}_2$  molecule, the number of lone pairs of electrons around the central oxygen atom is***

(a) 0

(b) 1

(c) 2

(d) 3

(e) 4

*5. The electronic structure of the  $\text{SO}_2$  molecule is best represented as a resonance hybrid of \_\_\_\_ equivalent structures.*

(a) 2

(b) 3

(c) 4

(d) 5

(e) This molecule does not exhibit resonance.

***6. Draw one of the resonance structures of  $SO_3$ . The formal charge of S is***

(a) +2

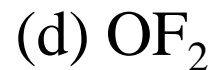
(b) +1

(c) 0

(d) -1

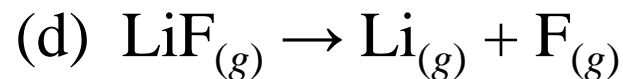
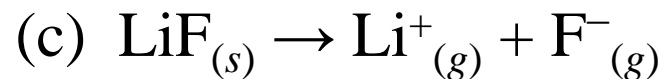
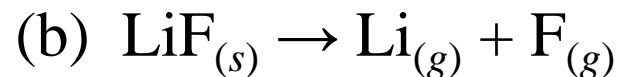
(e) -2

***7. Which one of the following violates the octet rule?***





***8. The lattice energy of LiF is 1037 kJ/mol. This energy corresponds to which reaction below?***



**9. Which of the following bonds is most polar?**

(a) N–Cl

(b) B–F

(c) Si–Br

(d) C–H

***10. What is the formal charge on each atom in the hypochlorite ion,  $\text{OCl}^-$ ?***

(a)  $\text{O} = +1, \text{Cl} = -2$

(b)  $\text{O} = -1, \text{Cl} = 0$

(c)  $\text{O} = 0, \text{Cl} = -1$

(d)  $\text{O} = -1, \text{Cl} = +1$

***11. A covalent double bond contains how many electrons?***

- (a) 1
- (b) 3
- (c) 2
- (d) 4

***12. Which compound below contains the most polar bond?***

(a)  $\text{Cl}_2$

(b)  $\text{MgS}$

(c)  $\text{NaCl}$

(d)  $\text{FrF}$

***13. How many single and double bonds are in the most stable resonance structure of  $\text{NO}_3^-$ ?***

- (a) 3 single bonds, 0 double bond
- (b) 1 single bond, 2 double bonds
- (c) 0 single bond, 3 double bonds
- (d) 2 single bonds, 1 double bond

***14. What are the formal charges on O, N, and Cl in the Lewis structure below? Only the bonds are shown; lone pairs are not shown.  $O-N=Cl$***

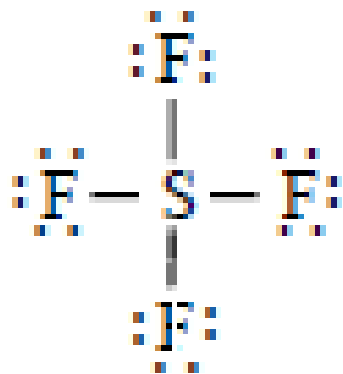
- (a)  $O = -1; N = 0; Cl = +1$
- (b)  $O = -1; N = +1; Cl = -2$
- (c)  $O = +1; N = -1; Cl = 0$
- (d)  $O = -1; N = +2; Cl = -1$

***15. When drawing Lewis structures, which one of the following compounds violates the octet rule?***



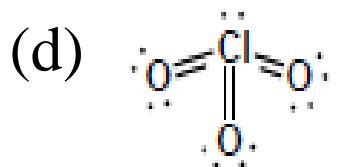
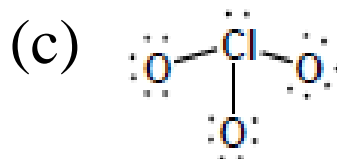
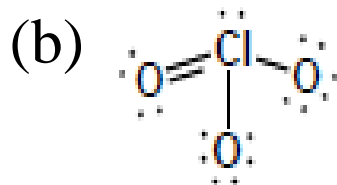
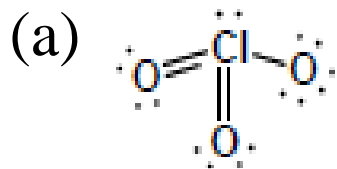


***16. What is wrong with the structure of SF<sub>4</sub> below, if anything?***

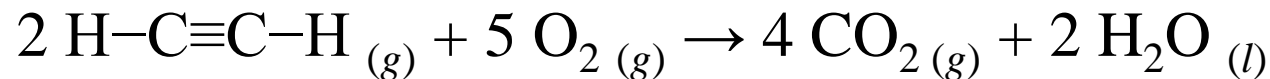


- (a) The Lewis structure is correct.
- (b) There should be a lone pair of electrons on S.
- (c) There should be a double bond between S and F.
- (d) One of the F atoms should be the central atom in order to have the correct formal charges.

***17. Using formal charges, which one of the following Lewis structures is correctly drawn for the  $\text{ClO}_3^-$  ion?***



***18. Using average bond energies, calculate  $\Delta H_{rxn}$  for the combustion of acetylene, shown in the reaction below.***



Bond	Bond Energy (kJ/mol)
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C-H	414
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C-C	347
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C $\equiv$ C	837
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O=O	498
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C=O	799
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O-H	464
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(a) -1500 KJ

(b) -3256 KJ

(c) -2428 KJ

(d) -4918 KJ

## Practice Exercise

The dipole moment of chlorine monofluoride,  $\text{ClF}(g)$ , is 0.88 D. The bond length of the molecule is 1.63 Å.

- (a) Which atom is expected to have the partial negative charge?
- (b) What is the charge on that atom in units of  $e$ ?